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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/800,195	03/12/2004	Junyan Dai	5347.218	8744

20792 7590 10/18/2005

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EXAMINER
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LEE, SIN J

ART UNIT	PAPER NUMBER
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1752

DATE MAILED: 10/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/800,195

Applicant(s)

DAI ET AL.

Examiner

Sin J. Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 05 August 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-8, 10-22, 24-26, 32-35, 37-40, 44-48, 51, 52, 54-59 and 62-66 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 12, 13, 19 and 32-35 is/are allowed.
- 6) ☒ Claim(s) 1-8, 10, 11, 14-18, 20-22, 24-26, 37-40, 44, 46-48, 51, 54-59 and 62-66 is/are rejected.
- 7) ☒ Claim(s) 45 and 52 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>8-19-04</u> . | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

1. Due to new grounds of rejections, the following rejections are made non-final.

#### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 3 and 4 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no support in the original disclosure for the silicon-containing resist polymer comprising 0.1-40% by weight (or 1.8-19.8 % by weight) of *silane*.

4. Claim 8 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no support in the original disclosure for the generic "vinylsilane" (the only vinylsilane shown in present specification is dimethylphenylvinylsilane on pg.8).

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 39 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claim 39, applicants recites that the *monomer* comprises a *polymer* selected from the group consisting of isoprene, styrene, and *vinyl*. How can a monomer comprise a polymer? Also, what do applicants mean by “vinyl”?

Appropriate correction is required.

7. Claims 26 and 48 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claim 26, applicants recites that “polymer comprises an element selected from the group consisting of . . . vinyl and . . .”. What do applicants mean by “vinyl”? Also, in claim 48, applicants recite that “the polymer comprises a polymer selected from the group consisting of . . . vinyl, . . .”. What do applicants mean by “vinyl”?

Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

8. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

9. Claims 1-4, 6, 8, 17, 20-22, 37-40, 57, 58, 65 and 66 are rejected under 35 U.S.C. 102(b) as being anticipated by Leveriza et al (4,764,247).

Leveriza teaches a photoresist material used in the production of semiconductor devices comprising copolymer of trimethylsilylstyrene (which is another name for (ethenylphenyl)trimethylsilane) and chloromethylstyrene (see abstract and Example I).

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The copolymer of trimethylsilylstyrene and chloromethylstyrene teaches the first polymer listed in present claim 20. Thus, Leveriza teaches present inventions of claims 1-4, 6, 8, 17, 20-22, 37-40, 57, 58, 65 and 66.

10. Claims 1-4, 6, 8, 18, 20-22, 37-40, 57, 58, 65 and 66 are rejected under 35 U.S.C. 102(b) as being anticipated by Watanabe (JP 62-280839 and its Chemical Abstract 108:213981 for JP 62280839 A2).

Watanabe (see chemical abstract) teaches a resist material containing the copolymer of pentamethyldisilylstyrene (another name for (4-ethenylphenyl)pentamethyldisilane) and chloromethylstyrene. Watanabe's copolymer teaches the second present copolymer listed in claim 20. Thus, Watanabe teaches present inventions of claims 1-4, 6, 8, 18, 20-22, 37-40, 57, 58, 65 and 66.

11. Claims 1-4, 22, 37, 40, 57, 58, 65 and 66 are rejected under 35 U.S.C. 102(b) as being anticipated by Felter et al (5,989,776).

Felter teaches a method of producing a patterned array of features in the size range of 0.4-0.05 um using projection lithography and *extreme ultraviolet radiation*, and Felter performs the lithography by using a photoresist composition containing organosilicon polymer such as poly(cyclohexylmethyl-co-trimethylsilylmethyl silane). (see abstract and col.5, lines 8-26). Felter's photoresist material contains little or no oxygen because oxygen is strongly attenuating for short wavelength radiation (see col.5, lines 8-14). Therefore, Felter teaches present inventions of claims 1-4, 22, 37, 40, 57, 58, 65 and 66.

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12. Claims 24, 25, 44, 46, 47, 51, 54, and 56 are rejected under 35 U.S.C. 102(b) as being anticipated by Matsumoto et al (5,386,006).

Matsumoto teaches (col.3, lines 34-38) polysilazanes with boron-carbon bonded substituents on the polysilazane backbone, which are prepared by the hydroboration of alkenyl or alkynyl-substituted polysilazanes. Matsumoto teaches that preferably boron content is 0.3-1.0 wt% in the polymer (col.10, lines 6-14). Therefore, the prior art teaches present inventions of claims 24, 25, 44, 46, 47, 51, 54, and 56.

13. Claim 55 is rejected under 35 U.S.C. 102(b) as being anticipated by Chung et al (5,247,023).

Chung teaches (col.1, lines 7-10) a polymeric hydrocarbon compounds having reactive borane groups at chain ends, or within the polymer chain. Such compounds are made by an olefin exchange reaction between an unsaturated high molecular weight polymer and a borane monomer (col.3, lines 1-3). As one of examples for the starting polymer, Chung teaches 1,4-polyisoprene (see col.4, lines 12-19). Therefore, Chung teaches present invention of claim 55.

#### ***Claim Rejections - 35 USC § 103***

14. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

15. Claims 59 and 62-64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Felter et al (5,989,776) in view of Lin (5,304,453).

As explained above in Paragraph 10, Felter teaches a method of producing a patterned array of features in the size range of 0.4-0.05 um using projection lithography

and extreme ultraviolet radiation, and Felter performs the lithography by using a photoresist composition containing organosilicon polymer such as poly(cyclohexylmethyl-co-trimethylsilylmethyl silane). Felter coats his photoresist material onto a silicon substrate, and the photoresist is then exposed to extreme UV radiation. After the development, the remaining photoresist is used as an etch barrier in the following oxygen plasma etching step. (see col.5, lines 8-46, col.6, lines 16-17). It is well known in the art that the oxygen plasma etching and oxygen reactive ion etching are interchangeable plasma etching techniques, as evidenced by Lin, col.2, lines 48-50. Therefore, it would have been obvious to one of ordinary skill in the art to use oxygen reactive ion etching technique in Felter's invention because oxygen plasma etching and oxygen reactive ion etching were art-recognized equivalents at the time the invention was made. Therefore, Felter in view of Lin would render obvious present inventions of claims 59 and 62-64.

16. Claims 1-7, 10, 11, 14-16, 22, 57, 58, 65 and 66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ober et al (5,290,397).

In Example 4, Ober teaches E-beam exposure and development of *pentamethyldisiloxane* modified polystyrene-polyisoprene block copolymer, which contains a silicon weight percent of *at least about 5 percent*. Ober teaches (col.6, lines 1-13) that the silicon component is incorporated into the block copolymer using a *hydrosilylation* reaction. Ober also teaches that instead of hydrosiloxane such as pentamethyldisiloxane, *hydrosilanes* can also be used in incorporating the silicon component into the block copolymer (see col.6, lines 40). Therefore, it would have

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been obvious to form a hydrosilane modified polystyrene-polyisoprene block copolymer with a reasonable expectation of obtaining bilayer resist which provides good resolution, sufficient etching protection yet also exhibits dimensional stability. Therefore, Ober's teaching renders obvious present inventions of claims 1-7, 10, 11, 22, 65 and 66 (assuming that Ober's copolymer contains 5 wt.% of silicon, this value lies within the present ranges of claims 3 and 4, and thus, it is the Examiner's position that Ober's copolymer would inherently have an oxygen reactive ion etch rate of not more than about 0.35 nm/s as presently recited in claim 2. Also, since claim 11 is written in product-by-process claim language, it is the Examiner's position that Ober's hydrosilane modified polystyrene-polyisoprene block copolymer, which is made by hydrosilylation reaction, would also teach present invention of claim 11 even though Ober uses different hydrosilylation catalysts).

Ober teaches (col.5, lines 18-20) that his block copolymer has molecular weight range of 500 to 10,000,000. Since this range overlaps with present ranges of claims 14-16, the prior art's range would have made present range *prima facie* obvious. In the case "where the [claimed] ranges overlap or lie inside ranges disclosed by the prior art," a *prima facie* case of obviousness would exist which may be overcome by a showing of unexpected results, In re Wertheim, 541 F.2d 257, 191 USPQ (CCPA 1976). Therefore, Ober's teaching renders obvious present inventions of claims 14-16.

With respect to present claims 57 and 58, Ober teaches a process for forming a resist pattern which includes a step of reactive ion etching (see claims 1 and 6). Also, in col.2, lines 2-4, Ober states that the etch rate of the polymer decreases as the wt.% of



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silicon increases. Therefore, Ober's teaching renders obvious present inventions of claims 57 and 58.

***Allowable Subject Matter***

17. Claims 45 and 52 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Matsumoto et al '006 does not teach or suggest present hydroboration agent, dimesitylborane, of claims 45 and 52.

18. Claims 12, 13, 19, 32-35 are allowed. None of the cited prior arts teaches or suggests the present poly(dimethylphenylvinylsilane-b-isoprene) of claim 12 or the present poly(trimethylsilylstyrene-b-isoprene) of claim 13. None of the cited prior arts teaches or suggest present polymers of claim 19. None of the cited prior arts teaches or suggest present polymer of claim 32, 34 or 35.

19. Applicants argue that Ober does not anticipate claims 1 and 57, which now require silane. However, as explained above in Paragraph 16, Ober's teaching renders obvious present inventions of claims 1 and 57. Applicants argue that Felter et al does not make present inventions of claims 57-64, which now require silane, obvious.

However, as explained above in Paragraph 11, Felter teaches present inventions of claims 1-4, 22, 37, 40, 57, 58, 65 and 66, and as explained above in Paragraph 15, Felter in view of Lin renders obvious present inventions of claims 59 and 62-64.

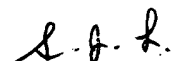
20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is 571-272-1333.

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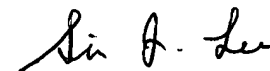
The examiner can normally be reached on Monday-Friday from 9:00 am EST to 5:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cynthia Kelly, can be reached on 571-272-1526. The fax phone number for the organization where this application or proceeding is assigned is **571-273-8300**.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



S. Lee  
October 13, 2005



**SIN LEE**  
**PRIMARY EXAMINER**